**Chapter 3: (VLANs)**

VLANs are logically separated networks on a LAN that share the same infrastructure (switch). They help to limit broadcast domains.

Normal Range VLANs:

- VLAN ID is between 1 and 1005 (1, 1002, and 1005 are automatically created)

- Configurations stored in vlan.dat file (located in flash memory)

- Information can be transmitted through VTP

Extended Range VLANs:

- VLAN ID is between 1006 and 4094

- Supports fewer VLAN features compared to normal range ones

- Saved in running configuration and not transmitted through VTP

Types of VLANs:

- Data VLAN -- carries user-generated traffic

- Default VLAN -- allows all switch ports to intercommunicate, also CDP and STP traffic

- Native VLAN -- assigned to an 802.1Q trunk port

- Management VLAN -- used to access the management features (default is VLAN 1)

- Voice VLAN -- supports voice traffic, quality of service for voice frames

Switches with layer 3 capabilities are able to communicate between multiple VLANs using SVI (switch virtual interface). The SVIs know the locations of the other VLANS. If no such switch exists, a router can also be used for inter-VLAN communication.

VLAN Trunks:

- Point-to-point link link between two network devices that carries more than one VLAN

- 802.1Q is used to coordinate trunking on FastEthernet and GigabitEthernet interfaces

- With trunks, one switch port can be used to carry traffic for multiple VLANs

802.1Q Frame Tagging:

- Adds two additional fields to frames to signal which VLAN the frame is designated for

- EtherType = 0x8100 (TPID) -- tells switch to look for tag control information field

- Tag Control Information -- 12 bits containing the VLAN ID (up to 4096), 4 other bits too

- After the EtherType and TCI fields are updated, the FCS field in the frame is updated

IOS Commands:

- vlan [ID] -- creates a VLAN with a given number (ID)

- name [NAME] -- specifies a name for the VLAN (in config-vlan)

- switchport mode access -- sets the VLAN membership mode for the port

- switchport mode trunk -- force the link connecting the switches to be a trunk link

- switchport access vlan [ID] -- assigns a switch port to a VLAN number

- no switchport access vlan -- resets VLAN assignment and membership for the port

- switchport trunk native vlan [ID] -- sets another VLAN as the native VLAN

**Chapter 4: (VTP)**

VLAN Trunking Protocol (VTP):

- Allows a switch to propagate VLAN configurations to other switches on the network

- VTP server distributes and synchronizes VLAN information among the VTP clients

- After a trunk link is setup between VTP server and client, advertisements can be sent

- Components of VTP:

- VTP domain -- group of interconnected switches that communicate using VTP

- VTP advertisements -- used to update VTP configurations over the network

- VTP modes -- server, client, or transparent (each serves a different purpose)

- VTP server -- advertises VTP information for the domain the switch is in

- this is the only place where VLANs can be created, deleted, or modified

- VTP client -- receives VLAN information from a VTP server switch for domain

- VTP transparent -- forwards VTP advertisements between client and server

- however, transparent mode switches do not use VTP themselves

- VTP pruning -- improves network performance by restricting the trunk links that traffic crosses, allowing only the ones necessary to reach destination.

VTP Configuration:

- Version -- default is one (1, 2, or 3), one domain must use only one version

- Domain name -- defines the domain that the switch and VLANs operate on

- Other fields...

VTP Advertisements:

- VTP frame is encapsulated in an 802.1Q Ethernet frame and send as multicast

- VTP revision number -- 32-bit number increased every time VLAN data is updated

- changing the domain name resets the revision number to zero

Types of VTP Advertisements:

- Summary advertisements -- contain the VTP domain name, revision number, and other general configuration details, sent every 5 minutes or on config. update

- Subset advertisements -- sent when a VLAN is created, deleted, or updated

- Request advertisements -- sent on switch reset, domain name change, or when a possible error is detected, switch responds by sending summary advertisement and then a subset advertisement.

Potential Problems with VTP Communications:

- Version numbers do not match

- Domain names do not match

- Passwords do not match

- Incorrect revision numbers

IOS Commands:

- show vtp status -- displays VTP configuration information for the switch

- show vlan brief -- shows basic information on all VLANs

- show interfaces trunk -- show all interfaces that are on the trunk line

- vtp mode [MODE] -- sets the VTP mode (client, server, or transparent)

- vtp domain [DOMAIN] -- sets the domain name for the VTP configuration

- vtp version [NUMBER] -- sets the version number for the VTP configuration

- vtp password [PASSWORD] -- sets the password for the VTP configuration

**Chapter 6: (Inter-VLAN Routing)**

VLANs can communicate with each other through a router. Traditionally the router has one line (one FastEthernet interface) per VLAN, however this can be changed. (Option #1)

Router-on-a-Stick: (Option #2)

- There is only one physical line between the router and the switch, the trunked line

- Router accepts tagged traffic and responds through a subinterface

- A subinterface is a logical interface on a single physical interface (eg: Fa0/0.10)

- Router forwards tagged frames rom one subinterface to another subinterface

- Subinterfaces are used so that trunking between the switch and router can occur

Layer 3 Switch: (Option #3)

- Also known as multilayer switching (and IP routing must be enabled on the switch)

- The layer 3 switch routes the tagged frames between its VLAN interfaces

Physical Interface vs. Subinterface:

- One physical interface per VLAN vs. one physical interface for all VLANs

- No bandwidth contention on separate physical interfaces

- Physical uses access mode switch port, while subinterface uses trunk mode

- Physical is more expensive but less complex, while subinterface is the opposite

Each of the three options to implement Inter-VLAN routing on a switch involves different configuration options and commands on a switch or router.